

$$\begin{aligned}
R_s[n, m] = & \sum_{l=-\infty}^{\infty} \left( h_u^t[n - lN] P h_u[n + m - lN] \right. \\
& + \sum_{r=0}^{R-1} h_I^t[n - lN] C^t[r] P h_u[n + m - (l - r)N] \\
& + \sum_{r=0}^{R-1} h_u^t[n - lN] P C[r] h_I[n + m - (l + r)N] \\
& \left. + \sum_{r=0}^{R-1} \sum_{\rho=0}^{R-1} h_I^t[n - lN] C^t[r] P C[\rho] h_I[n + m - (l - r + \rho)N] \right) + CC.
\end{aligned} \tag{114}$$

In order to obtain equation (114), statistically independent data with the same power in the real and the imaginary portion were assumed. P is a diagonal matrix whose elements match the power of the channels used

$$P = \text{diag}\{\sigma_{A_{u_1}}^2, \sigma_{A_{u_2}}^2, \dots, \sigma_{A_{u_U}}^2\} \quad \text{with} \quad \sigma_{A_{u_i}}^2 = E\{|A_{u_i}|^2\}, \quad \{u_1, u_2, \dots, u_U\} = \mathcal{K}_U. \tag{115}$$

(114) discloses the periodic nature of  $R_{sn}, m$ , each  $n + pN$  yields the same result as  $n$ . To eliminate this periodicity,  $R_{sn}, m$  is taken the mean of over one period.

$$R_s[m] = \frac{1}{N} \sum_{n=0}^{N-1} R_s[n, m] \quad (116)$$

$$\begin{aligned}
&= \frac{1}{N} \sum_{n=0}^{N-1} \left( \sum_{l=-\infty}^{\infty} \left( h_{\mathcal{U}}^t[n - lN] P h_{\mathcal{U}}[n + m - lN] \right. \right. \\
&\quad + \sum_{r=0}^{R-1} h_{\mathcal{I}}^t[n - lN] C^t[r] P h_{\mathcal{U}}[n + m - (l - r)N] \\
&\quad + \sum_{r=0}^{R-1} h_{\mathcal{U}}^t[n - lN] P C[r] h_{\mathcal{I}}[n + m - (l + r)N] \\
&\quad \left. \left. + \sum_{r=0}^{R-1} \sum_{\rho=0}^{R-1} h_{\mathcal{I}}^t[n - lN] C^t[r] P C[\rho] h_{\mathcal{I}}[n + m - (l - r + \rho)N] \right) \right) + \text{CC} \quad (117)
\end{aligned}$$

$$\begin{aligned}
&= \frac{1}{N} \sum_{n=0}^{N-1} \left( h_{\mathcal{U}}^t[n] P h_{\mathcal{U}}[n + m] \right. \\
&\quad + \sum_{r=0}^{R-1} h_{\mathcal{I}}^t[n] C^t[r] P h_{\mathcal{U}}[n + m + rN] + \sum_{r=0}^{R-1} h_{\mathcal{U}}^t[n] P C[r] h_{\mathcal{I}}[n + m - rN] \\
&\quad \left. + \sum_{r=0}^{R-1} \sum_{\rho=0}^{R-1} h_{\mathcal{I}}^t[n - lN] C^t[r] P C[\rho] h_{\mathcal{I}}[n + m + (r - \rho)N] \right) + \text{CC} \quad (118)
\end{aligned}$$

Since  $\mathbf{h}_{\mathcal{U}}[m]$  and  $\mathbf{h}_{\mathcal{I}}[m]$  only have a support in the range  $0 \leq n < N$ , summation over  $l$  in equation (117) is reduced to the term for  $l = 0$ , whereas all the other terms are equal to zero.

The use of the discrete Fourier transformed on  $R_s[m]$  yields the power density spectrum

$$S_s(e^{j\theta}) = \sum_{m=-\infty}^{\infty} R_s[m]e^{-j\theta m} \quad (119)$$

$$\begin{aligned}
&= \frac{1}{N} \sum_{m=-RN+1}^{RN-1} \left( \sum_{n=0}^{N-1} \left( h_{\mathcal{U}}^t[n] P h_{\mathcal{U}}[n+m] \right. \right. \\
&\quad + \sum_{r=0}^{R-1} h_{\mathcal{I}}^t[n] C^t[r] P h_{\mathcal{U}}[n+m+rN] + \sum_{r=0}^{R-1} h_{\mathcal{U}}^t[n] P C[r] h_{\mathcal{I}}[n+m-rN] \\
&\quad \left. \left. + \sum_{r=0}^{R-1} \sum_{\rho=0}^{R-1} h_{\mathcal{I}}^t[n-lN] C^t[r] P C[\rho] h_{\mathcal{I}}[n+m+(r-\rho)N] \right) + \text{CC} \right) e^{-j\theta m}
\end{aligned} \quad (120)$$

Since  $R_s[m]$  only differs from zero in the range  $-RN < m < RN$ , summation in the equation (120) only has to be carried out in a finite interval.

As we now have an expression for the power density spectrum  $S_s(e^{j\theta})$ , a criterion may now be formulated which is to be optimized with regard to the coefficients  $C[r]$ ,  $r = 0, 1, \dots, R-1$ . It is the object of the present invention to suppress the transmitted signal within the fade-out range. The criterion used for optimization according to the invention is the weighted integral of  $S_s(e^{j\theta})$ .

$$\psi_1(C[0], C[1], \dots, C[R-1]) = \int_0^{2\pi} W(e^{j\theta}) S_s(e^{j\theta}) d\theta \quad (121)$$

$W(e^{j\theta})$  is the weighting function. When  $W(e^{j\theta})$  is set to 1 or outside zero within the fade-out range, the equation (121) is the transmitted power within the fade-out ranges. This choice